Institutional Options and Operational Issues in Technology Assessment: Lessons from Experiences in the United States and Europe

H. Shiroyama, G. Yoshizawa, M. Matsuo, T. Suzuki
University of Tokyo
7-3-1 Hongo, Bunkyo-ku
Tokyo 113-0033 Japan

***Abstract*–This paper illuminates widening variety of technology assessment (TA) activities by parliamentary organizations and other bodies in the United States and Europe. It also illustrates a range of institutional options for TA from the view of its key elements, and examines the operational issues. Based on extensive interviews with TA practitioners and other related actors, we identified the recent direction of TA activities and provide discussion materials for states and regions in which there is a growing concern about the institutionalization of TA functions.**

I. Introduction*

Technology assessment (TA), symbolized as 'early warning' in its initial development stage, has been recognized that TA gives a warning against policymakers in the early stage of technological development by analyzing (particularly negative) societal impacts of future technology. There have been increasingly a wider variety of TA activities since the birth of a parliamentary organization dedicated to TA in the United States in the 1970s, which was followed by the establishment of the subsequent TA organizations affiliated with various European parliaments, and the widening TA activities in other government agencies, NGOs and universities. Such variety implies that the institutionalization of TA is now undergoing with different purposes in diverse political and social contexts. This paper illuminates various TA activities undertaken mostly by TA organizations connected to parliaments in the United States and Europe. It also illustrates a range of institutional options for TA from the view of its key elements, and examines the operational issues.

Piled individual studies on the Office of Technology Assessment (OTA), which was a parliamentary TA organization in the US, and some TA organizations affiliated with parliaments in Europe, have mainly targeted at activities around the turn of the century [1][2][3][4]. Among them, there are relatively few studies on TA experiences in the US and Europe from a comparative and comprehensive perspective [5][6]. Few and dispersed information is available for the movements in this century including various TA activities in other government agencies, NGOs and universities. Based on extensive interviews with TA practitioners and other related actors, we provide discussion materials for states and regions in which there is a growing concern about the institutionalization of TA functions.

Key elements in the institutional arrangement of TA in our analysis include organizational affiliation (e.g. parliament, administrative agency, private sector), sponsor (e.g. parliament, administrative agency, private sector), member of the steering committee (e.g. parliamentarians, experts), implementing body (e.g. parliamentarians, internal staff, contractors), and addressee (e.g. parliament, administrative agency, the public). Operational issues to be discussed include considerations in the introduction of TA institutions reflecting political and social contexts, TA methods, TA practitioners' competence and training support for them.

II. Diversity of Institutional Arrangements

A. Organizational Affiliation

There may be at least three types of the organizational affiliation for TA. The first type is parliament. Examples include OTA, the Parliamentary Office of Science and Technology (POST, UK), the Parliamentary Office for Evaluation of Scientific and Technological Options (OPECST, France), the Technology Assessment Bureau of the German Parliament (TAB), the Flemish Institute for Science and Technology Assessment (viWTA), and the Science and Technology Options Assessment (STOA, European Parliament). In the states with bicameral legislature, TA organizations can be affiliated with either both houses or a single house. The former applies to US, UK and France whereas the latter applies to Germany (TAB is set in the lower house). In the case of UK, POST is affiliated with both houses, but the function of which has to be strategically differentiated from the Select Committee on Science and Technology in the House of Commons, that has historically played a certain role by deep analysis of scientific and technological issues. This is one of the reasons why POST focuses on the publication of brief reports called *POST Note*.

In setting a TA organization affiliated with parliament, there had been issues on bureaucratization of parliamentary organizations raised in some countries. In the UK, at first, a TA organization was established outside the parliament, and it was then moved in the parliament after an experimental

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period of a few years. In Germany, the authority did not establish a new parliamentary organization but assigned a political management function to an existing parliamentary committee and commissioned the practical implementation to TAB as an external scientific expert organization. In France, OPECST was installed not as a parliament committee but as a representative section of the parliament since the additional setting of a parliamentary committee was restricted.

Distinguishing TA activities from the parliamentary library service is also an issue to be examined. Considerable argument arose in US, UK and Germany, but as a consequence, the request for TA organization is to be limited to organizational request from committees and others, not personal request from individual parliamentarians and their staff, which could be undertaken by the parliamentary library.

The second type is administrative body. A good example is the Danish Board of Technology (DBT). This agency was initially under the political authority of a parliamentary committee. However, because the politically balanced perspective is expected in the Danish society and any parliamentary organizations are not permissible under the Constitution, DBT was finally set up in the Ministry of Research. Many TA-like activities including foresight in the UK and the European Commission are undertaken in administrative agencies.

The third type is functional setting in private sectors. This type can be subdivided into five categories. (1) Academy of Sciences such as the National Research Council (NRC) in the US, the Rathenau Institute in the Netherlands, the Center for Technology Assessment (TA-SWISS) in the Switzerland, and the Institute of Technology Assessment (ITA) in Austria. In this case, institutional independence can be guaranteed to some extent, but because in some cases TA activities are evaluated in academic terms, the independence is to be counterbalanced by less direct influence toward the decision-making system. (2) Public interest groups such as the Woodrow Wilson International Center for Scholars in the US and the King Baudouin Foundation in Belgium. (3) Universities, such as the Center for Nanotechnology in Society in Arizona State University (CNS-ASU). (4) Advocacy groups, such as the International Center for Technology Assessment and other NGOs with specific interests. (5) Collaboration between private firms and NGOs. A typical example is Environmental Defense - DuPont Nano Partnership Program.

B. Sponsor

The sponsor for TA closely corresponds to the organizational affiliation. TA organizations set in the private sector have various financial resources. In most of the case, governments provide some resources. In the Netherlands, the Ministry of Education, Culture and Science (OCW) is the sponsor for TA, and so are federal governments in Switzerland and Austria. The U.S. 21st Century Nanotechnology R&D Act of 2003 stipulates the budget allocation for the implementation of TA, by which CNS-ASU has been conducting TA. NRC in the US is also sponsored mainly by the federal government, but on the basis of individual contracts with government agencies. NRC tries to guarantee independence by balancing resources from plural agencies [7]. Wilson Center in the US has one third of their fund coming from the Congress. In most other TA activities, main sponsors are private firms and foundations.

C. Member of the Steering Committee

The steering committee plays a role in agenda setting and project management, except for OPECST, the steering committee of which does not set an agenda by its own. There can be three types of the steering committee.

The first type consists of members of parliament (MPs) only. OTA, OPECST, German parliamentary committee in charge of a management of TAB, and STOA are some examples. In all these cases, the committee takes a reasonable balance between members from different parties and undertakes bipartisan management on a consensus basis. This makes it easy for them to commission a TA project faithfully reflecting parliamentary needs.

The second type consists of MPs and external experts, as observed in POST and viWTA. Some point out that this can make a good balance between politics and science.

The third type consists of only external experts, as observed in the Rathenau Institute, DBT, TA-SWISS and ITA. As to Rathenau, the members of committee are recommended by KNAW (Royal Netherlands Academy of Arts and Sciences) and WRR (Scientific Council of Government Policy) and appointed by OCW. For DBT, the chair and three individuals in the steering committee are selected and appointed by the Minister of Research, and the rest are recommended by designated organizations and appointed by the Ministry of Research [8]. TA-SWISS committee members are determined by the Swiss Science and Technology Council after the consultation between the Federal Ministry of Interior, the Federal Ministry of Economy and the director of TA-SWISS.

D. Implementing body

Our analysis identified four different types of TA implementing body.

First, there are cases in which MPs undertake TA exercises by themselves, a typical example of which is OPECST. It is of course in this case that they as practitioners know well user needs, i.e. their own needs. The problem to be addressed is that committed members, who ought to have to a certain extent scientific and technological knowledge, are to be limited in number.

Second, staff in TA organizations conducts TA and takes authorship of TA reports. Examples include OTA, POST, Rathenau and ITA. TA can suit MPs' needs if the internal staff keeps in close touch with them.

Third, external experts in the committee take authorship of TA reports. In NRC, this kind of voluntary commitment might allow experts who take much time to attract others to their own views [7]. In the case of DBT, in cases where collaboration among actors are required, various experts and

stakeholders participating in the committees called cross disciplinary working groups, write report by themselves. In the case of consensus conference of DBT, participating citizens also write reports by themselves.

Fourth, in STOA and TAB, TA implementation is contracted out to external organizations. German parliament is outsourcing to TAB, an external scientific expert organization with the fear of the extension of parliamentary bureaucracy. But the mechanism is designed to improve the communication between TAB staff and MPs as TA users, and at the same time the directorship of MPs against TAB as an external organization of parliamentary committee is guaranteed. In addition, further outsourcing from TAB to other external organizations is restricted. OTA in the US contracted out most studies to external bodies in its initial stage. Such contractors, however, did not have much information about in what political and social contexts TA can be utilized in the actual policymaking. This changed the TA process so that OTA staff conducts TA. It seems that outsourcing also abounds in TA-SWISS, except in the case of participatory TA.

E. Addressee

Major addressee of TA report can be divided into three categories.

First, the addressee is parliament, as in the cases of OTA, POST, OPECST, and TAB. Most of these parliamentary TA organizations target not individual MPs (as in the case of the Congressional Research Service in the US) but parliamentary organizations such as committees. In the case that the main addressee is parliament, however, not only is parliament the substantive target in a narrow institutional sense. OTA targeted not just parliament but rather issue networks as a collection of public and private experts on certain policy agenda [9].

Second, the addressee is administrative agency as in the early days of the Netherlands Office of Technology Assessment (NOTA). NOTA then started reporting to the parliament as well. Such official report to administrative agencies as well as parliament, as in the Dutch Health Council, can take place perhaps because of the Dutch own governance structure [6]. DBT of Denmark also reports both to parliament and various administrative agencies (not limited to the Ministry of Research where it is located). Likewise, TA-SWISS and ITA, each in the Academy of Sciences, give a report to federal government or administrative agencies as well as parliament. NRC and similar agencies that undertake TA-like activities in the administration also have administrative agencies as the addressee.

The third category of addressee is citizens and general public. When reorganized in 1994, the Rathenau Institute added the promotion of public debate to their official aims. DBT and viWTA also aim to encourage public debate as well as the support for parliament. TA-SWISS organizes deliberation forum involving the public for contentious issues. Interesting is that addressees for ITA include not only administrative and parliamentary bodies but also the National Union of Workers and the Austrian Economic and Social Council, as their social partners.

III. OPERATIONAL ISSUES

A. Eyes on the Political Structure and Culture: Different Attitudes toward "Independence"

In designing a new TA institution, it is essential to keep eyes on the fact that different organizational features are needed for different political, social and cultural contexts in which TA organizations are embedded. For instance, OTA, in the country with the separation of powers, has been functioned partly as an instrument for the Congress to control the administration. From this perspective OTA is attached to the Congress, so that some are skeptical about the independence of OTA [1]. When Russell Peterson, the second director of OTA, attempted to encourage the independence of OTA from the Congress, he faced stiff opposition from the Congress and gave it up [10]. Basically, the affiliation with the Congress does not mean the attachment to specific major parties. Bipartisanship remains in the consensual procedure of TA implementation. The same applies to OPECST and STOA in essence. POST and TAB, both in the countries with parliamentary cabinet system, also retain this kind of stance under the parliament.

In the case of a TA organization under the Academy of Sciences, such as Rathenau, TA-SWISS and ITA, they intend to assure certain independence. Such an organization does not invite the members of steering committee from the parliament although they may consult with related government agencies in terms of the appointment of committee members. NRC also has a similar structure to this. Affiliated with a university, CNS-ASU performs certain independence despite the financial dependence on the government.

Somewhere in between the above two does DBT lay. The Danish parliament took a lead for the establishment of DBT, but the parliament expected DBT to manage by their own staying at arm's length and to keep politically balanced perspective. The legislative restriction that it is forbidden to establish any parliamentary organization, also made DBT be placed in the administration. Because its addressees include the parliament and the public and it keeps direct contacts with parliament and various administrative organizations, DBT is able to conduct independent operation from the administrative ministry where it is located.

B. Process of the Introduction: the Utilization of Experiments and Events

In the introduction processes of most European parliamentary TA organizations, the authority set up experimental periods and thereby determined the permanent institutionalization. POST was established outside the parliament by a private fund in 1989, then accredited as a fixed-termed but official parliamentary organization in 1994, and eventually as permanent in 2001. In Germany, a lower house resolution in 1989 conduced to the establishment of TA organization with a three-year term limit, followed by the

permanent institutionalization in 1993. DBT also had a three-year term limit when established by law in 1985, underwent the twice extension of the term limit in 1988-89 and 1989-95, and eventually came to a permanent organization by the 1995 law.

In the political decision-making of such an introduction and establishment of TA organization, a social event provided a critical "window of opportunity". In Germany, the Chernobyl nuclear accident in the former Soviet Union allegedly made a substantial impact on the discussion about institutionalization of TA. The permanent institutionalization of POST in the UK was greatly affected by the food crisis (as typified by the BSE case) since the late 1990s.

C. TA Methods: from Early Warning to Participation

Early warning, which had originally expected as a TA function at the time of inauguration of OTA, had to be abandoned soon after the beginning of its operation. As known as Collingridge Dilemma, impacts cannot easily be predicted until the technology is extensively developed and widely used. But on the other hand, control or change is difficult when the technology has become entrenched [11][6]. As a result, OTA shifted its focus on early warning to "thorough, objective information and analysis to help Members of Congress understand and plan for the short- and long-term consequences of the applications of technology, broadly defined", and identified its own work as "a specific form of policy analysis" [10]. Later, practitioners in the European parliamentary TA organizations shared a common view on the difficulty with early warning. This facilitated the dissemination of idea on constructive TA (CTA), particularly in the Netherlands, which aims to assess and intervene the ongoing process of technological development in a consistent way [6]. Also in Germany, TA meant an examination and review of obstacles and options for new scientific and technological developments by identifying and analyzing the social, economic, and ecological opportunities associated with them [12]. In brief, there has never been sheer early warning function institutionally performed in the operation of TA, whether in the US or in Europe.

For the while, TA exercises have utilized in most cases participatory processes in whatever form. Given the pivotal role of advisory committee that involves major stakeholders and experts in the operation of OTA, the formation of a shared perception among committee members was one of key TA functions. This may mean that there is a certain commonality in the operational OTA and Rathenau and DBT, which explicitly introduced a participatory TA process. Every TA exercise does not entail participatory process, however. OPECST was once forced to conduct a consensus conference, but being skeptical about the participatory process, it persists that TA should be conducted by MPs, as legitimate representatives of the public. TA-SWISS under the Academy of Sciences undertakes both participatory and expert committee-based TA. NRC activities are based on expert committees. As to Germany, one pointed out that participatory TA does not fit German political culture. Participatory TA exercises are in effect various in terms of participants ranging from stakeholders only (US) to participants including the public (NL, DK), and in terms of the goal – whether consensus-oriented among the participants (DK) or not (US, NL).

D. TA Practitioners' Competence and Educational Support for Them

First of all, it is necessary for TA practitioners to have a competence not only to analyze the issue concerned but also to organize the relevant community. Analytical ability has to be trans-disciplinary to examine the interaction between interlinked issues. Organizational capability can be paraphrased by an ability to communicate with policymakers, which may employ a special technique [13]; or in other words, a capability to form a network with NGOs and public officials.

Then, how people can develop such a competence? An interesting exercise is the AAAS (American Association for the Advancement of Science) Science & Technology Policy Fellowship, by which approximately 30 junior science and engineering professionals serve in the Congress [13]. But there can be a doubt whether this kind of capability can be obtained afterwards. A director said that when interviewing candidates for staff, personality rather than educational background is focused.

It is also good to keep the balance of backgrounds to facilitate interdisciplinary perspective. In the case of ITA, internal staff's academic background is balanced between natural science and social and human science. Rathenau Institute does not expect much science and technology studies (STS) as a practical research field, but rather as a reservoir of young talents in recruiting staff.

E. Quality control

In institutionalizing TA, it is important to provide well-balanced TA output reports and to assure the quality. In POST, all the reports are peer-reviewed by the steering committee and reviewed by external experts before the publication. In OTA, a project team or a senior management selects external experts and asks them for review. NRC, by contrast, following an academic protocol, asks external experts for independent anonymous review [7]. There may be a matter of discussion on whether an academic review procedure in the Academy of Sciences is appropriate where reviewers may not be able to comprehend the political backdrop of a TA report. Established in the Academy of Sciences, the Rathenau Institute does not apply this procedure. In this sense, it seems different from TA-SWISS.

Important also is intra-organizational quality control. STOA's assessment reports in the 1990s required the establishment of an external advisory panel, the utilization of independent external experts, internal reviews by at least three reviewers, and the employment of a full-time editor [6]. ITA organizes in-house seminars and internal reviews involving those who are not in the project group. In the case of DBT,

open workshops involving divers actors are held after the framing of questions are formulated and draft reports sometimes without conclusion are prepared. In addition to this review process after drafting a TA report, the selection procedure of experts and the time management are also crucial in the quality control.

In the operation of OTA, some pointed out that the fact that the Congress is the user plays a great role in the quality assurance of TA reports. For this renowned experts and stakeholders had an incentive to commit to TA on the one hand and the Congress requested high quality of the products on the other hand [2]. In the case of OPECST, members of which are rapporteurs and authors of TA reports, there is variability in the quality of reports between the individual practitioners.

IV. Discussion – Toward third Generation of TA?

In this final chapter we discuss the historical phase of modern TA, and the necessity of collaboration between TA(-like) activities.

This paper has been focusing on the diversity of TA institutional arrangements in various countries with their operational issues so far. Here we would like to take another analytical standpoint focusing on the change of institutional arrangement over time. In this respect, discussions can be made on the paradigm shift from US parliamentary TA in the 1970s as the first generation, to participatory and constructive TA employing explicit communication methods in Europe in the 1980-90s as the second generation. In this vein, a further discussion point is whether there is any sign of the third generation observable at the moment.

A recent noteworthy movement is the rise of private-based TA, such as CNS-ASU and King Baudouin Foundation. Constructive TA, originate in the Netherlands, has extended its activities from those related to parliament to those collaborating with a wide range of on-site stakeholders in assessing technology and introducing it to the society. As in the case of the Environmental Defense - DuPont Nano Partnership Program, fascinating collaborations between advanced firms and NGOs become popular.

One feature of these activities is demonstrating a potential of interactive TA without governmental intervention. Given a co-evolution of technology and society in the modern context, this may indicate the possibility of actors' autonomous learning through the interaction between technology and society bypassing the government. Yet in some of these cases like CNS-ASU and several Dutch constructive TA exercises, it is to be noted that such activities are still maintained by government-related financial resources.

As described thus far, there are various TA and TA-like activities undertaken by parliamentary, administrative and private bodies in individual countries. There are also subdivisions within TA, such as medical technology assessment (MTA). ITA internally had a small group dedicated to MTA, which has recently become independent with a support from external foundations. In the UK, the National Institute for Clinical Excellence (NICE) was established under the Ministry of Health as a MTA organization with the societal background of allocation problem in the National Health Service (NHS). NICE assesses medical technology involving stakeholders such as industries and patient groups. Future critical issues may concern how divergent TA and TA-like activities collaborate each other. In effect, in France there is a lack of collaboration between parliamentary TA and other TA-like exercises in administrative agencies.

It may also be necessary for TA to collaborate with other related activities. TA, as evidenced by its name, is in a narrow sense an activity undertaken at the stage that the technology issued becomes tangible at some level. Risk communication can be put into this category. On the other hand, there is a case in which scenario analysis to envision trends of the society as a whole serves at the deliberation on policymaking and decision-making of individual technologies. Taking as an example the discussion on transition management in the Netherlands, it seems an endeavor to deal with issues for TA in a wider framework of the decision and steering of the direction of society, which is based on the accumulated evidences and experiences from constructive TA exercises. This leaves future critical issues on how we manage, in the whole policy process, combination among various policy analytical tools – risk communication, scenario analysis, and problem structuring as well as TA.

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